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ABSTRACT

Two studies addressed the relationship between elementary school students' knowledge of specific words and their comprehension of passages involving those words. In the first study, 39 students in grades 5 and 6 read 4 passages, answered comprehension questions, and defined words that were included in the questions. Most of the words in the questions were correctly defined by at least 40 percent of the sample. Children who could define the word were also more successful in answering the corresponding comprehension questions. A second study determined how accurate students were in predicting how well they knew the words in comprehension questions. Twenty-two fourth graders were asked to read a story, answer comprehension questions, rate how well they knew specific words in the narrative, and then give meanings for the words. Most students, generally 90 percent of the sample, were accurate in their estimation of word knowledge. However, the percentage of students who over-estimated their word knowledge increased with words that had a lower percentage correct on the definitions. As in the first study, students had a greater probability of answering the comprehension questions correctly if they knew how to define key words related to the question. Educational implications for actively teaching vocabulary in the lower grades are discussed. (Contains 6 tables and 18 references.) (SLD)

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Metacognition of Vocabulary Knowledge: A Preliminary Study

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ABSTRACT

There are few studies on the word knowledge of elementary students and none that we have found addressing the relationship of their knowledge of specific words to comprehending passages involving those words. Two studies address these issues. In the first study, a sample of Grade 5 and 6 students (N=39) read four passages, answered comprehension questions and defined words which were included within these comprehension questions. Most of the words within these questions were correctly defined by at least 40% of the sample. As well, if children could define the word, they were more successful at answering the corresponding comprehension question as opposed to if they did not know the correct definition. A second study determined how accurate students are in predicting how well they knew words in comprehension questions. The sample consisted of 22 Grade 4 students who were asked to read a story, answer comprehension questions, rate how well they knew specific words from the narrative, and then give meanings for the words. Most students were accurate in their estimation of word knowledge, generally 90% of the sample. However, the percentage of students who over-estimated their word knowledge increased with words which had a lower percentage correct on the definitions. As with Study 1, students had a greater probability of correctly answering comprehension questions if they knew how to define key words relating to the question. Educational implications for actively teaching vocabulary at lower grades are discussed.

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Vocabulary has long been recognized as a correlate of intelligence as assessed by IQ (Kaufman, 1994; Sternberg, 1987; Weschler, 1991) and academic success in several areas, especially in the area of reading and language comprehension (Bloom, 1976). There has been an increase in interest in vocabulary knowledge and how it relates to text (Graves, Juel & Graves, 1998), reviews of methods (Stahl, 1998) and research (Biemiller, 1998).

The development of vocabulary in the primary years varies markedly and is dependent on several factors. One such factor is whether the same root word is used for different meanings (e.g. whether **book, booked and rebooked** are considered to be one, two, three or more separate vocabulary items). Using a conservative criteria, (e.g. treating **book** as two words in referring to *books* we read and for *booking* (scheduling a trip), it appears that the *average* child learns from 1200 words a year or about 3 to 4 root words per day (Anglin, 1993; Biemiller, 1999). Because of the large number of words that must be learned, it is clearly important that children build vocabulary at a fairly rapid rate throughout elementary school. However, little effort is made in the primary grades to do so (Becker, 1977; Cantalini, 1987; Morrison et al, 1998). More emphasis on vocabulary is given in the upper elementary years, but this appears to have a limited effect for those who enter these grades with restricted vocabulary (Chall, Jacobs & Baldwin, 1990).

There were two specific aims within this study. A first aim was to determine the agreement between the students' self-report and the open ended definitions of the same word.The second aim was the investigation of the relationship between self-reports of vocabulary knowledge within a passage and the successful answering of comprehension questions (with the same word in the question).

In this paper, one study is reported of students' abilities to tell what words they know. Self knowledge of words is critical if students are to either actively infer meanings of unfamiliar or little known words on their own or to seek assistance from others regarding word meanings. Both Beck & McKeown (1991) and Graves, Juel and Graves (1998) emphasize the importance of *word consciousness* or *word awareness* in building vocabulary. The word conscious student is one who is interested in words, recognizes the correct usage of words and is vigilant for new meanings of words (Graves, Juel & Garves, 1998). Word consciousness is viewed as an important goal of vocabulary instruction and it is understood to ben an outcome of successful vocabulary instruction (Beck & McKeown, 1991; Stahl & Fairbanks, 1986; Graves, Juel & Graves, 1998). Indirect

evidence for this hypothesis is provided by the finding that one outcome of vocabulary instruction is measurable vocabulary gains, as compared to non-instructed controls, on words not included in the instruction (Stahl & Fairbanks, 1986).

It is understood that the word conscious student would have an accurate estimate of his or her own word knowledge. Curtis (1987) indicates that self-reports of specific vocabulary tends to overestimate word knowledge, but bear some relationship to vocabulary as assessed in other ways. Children at the grade 5 level showed some knowledge of how well they knew words, but their reports were not very accurate. We have found no studies have looked at the relationship between the word knowledge of elementary school students and their reading comprehension using those words.

Study 1:

Subjects:

Thirty-nine Grade 5 and 6 children in a laboratory school at the University of Toronto participated in this study (18 Grade 5 and 21 Grade 6 students).

Materials:

Canadian Test of Basic Skills (CTBS)-Comprehension Section (King, 1982). Four stories (*Circus Salad Story, Rusty Story , Lightning Bug Story, and Chinese Kite Story*) were used to assess comprehension in the students from the laboratory school. The readability of each of these stories (new Dale-Chall readability coefficient) were calculated using Readability Master 2000 software. The respective Dale-Chall readability grade levels were 3 for *Circus Salad and Rusty*, and 4 for *Lightning Bug* and *Chinese Kite*.

Each of the four stories were copied into the survey used in this study. Students were required to read the story and answer the comprehension questions. On the following pages, the text of the narrative was repeated along with the vocabulary which was assessed as being potentially more difficult for these students. Most of the words were identified by Readability Master as being potentially difficult for these students (i.e. those words not included on the list of 3000 words). Children were required to define each of these words in writing. The story was reproduced below these words with the vocabulary words in bolded lettering for easy identification.

Procedure:

The thirty-nine students were presented with the four stories in the form of an inventory called *Understanding Language and Vocabulary*. They were asked to read the stories and complete the comprehension questions before turning to the next page, which contained the open-ended vocabulary words which the students were required to define.

Results and Discussion:

Two judges rated whether the open-ended vocabulary words were correctly defined relative to the context by using the following criteria: one point was given if the judge believed the word was correctly defined, half-a-point if it were believed that the student *may* know what the word meant and zero points if the judge believed that the child did not know what the word meant. The ratings of the open-ended definitions were highly reliable (r=.98)

As it has been pointed out, rating words as either *known* or *not known* is problematic. As children and adults get older, understanding of concepts become more sophisticated. The general principle used in this study was whether the child's definition in our best estimate would allow them to understand a narrative which incorporated the test sentence. For example, if a child wrote that **divided** meant "*to cut into sections*" that definition would be given a full point since she communicated that she understands the word. If she had written "*to cut*", she may know the meaning of the word but she has not demonstrated it fully, so she would be awarded half-a-point. If she would have written that **divided** meant "*to share*", then she would have been awarded zero points. The authors of this study preferred a more liberal approach to whether a word was known or not known, as opposed to the more exacting principles set out by Weschler (1991) for the Vocabulary subtest of the WISC-III.

The percentage correct (as a percentage of the total sample, N=39) for each of the words used in the survey are shown in Table 1. The distribution of the percentage correct in the each of the grades is shown in parentheses. In the *Lightning Bugs Story*, the percentage correct is above 90% with the exception of the word **batting** (82%). Words for the remaining three stories tended to be more difficult for both grades. However, the majority of words are above the 40% of the entire sample, with the exception of the word **holed** (36%), which is an idiom.

The comprehension questions used in the survey *Understanding Language and Vocabulary* were drawn directly from the CTBS and the correct scoring was determined by the answer key of the testing manual. The percentage correct of these questions are shown in the descending order in Table 2. The easier questions, yielding higher percentages correct, were generally factual comprehension questions and could be answered by referring back to the text (e.g.C9 **Why are children *batting* at the air?**). Questions which yielded the lowest percentages correct were inferential questions which require the student to draw logical conclusions based on facts or to

demonstrate knowledge of the gist of the narrative (e.g. F25 **What is the author trying to show in the second paragraph?**).

Table 2 also shows the words which students were asked to define and the how successful they could be if they either knew how to define the word or if they did not know how to define the word. For the most part, if they could define the word, then the children tended to answer the corresponding comprehension question correctly. As above, the higher rates corresponded with factual questions and the lower rates with inferential comprehension questions. Successful answering of comprehension questions involving inferences may be dependent upon factors above and beyond vocabulary knowledge. However, if vocabulary knowledge is weak, this will lead to a lower probability of correctly answering an inferential comprehension question.

The first study only addresses word knowledge in the stories presented and does not address how accurate these students are in predicting how well they know these words. A necessary component of word consciousness is how successful students are in predicting if they could define a word. Thus, the second study was designed to address the issue of how accurately children can estimate their own vocabulary knowledge and how their estimates are related to their reading comprehension.

Study 2:

Subjects:

Twenty-two Grade 4 students at the same laboratory school as Study 1 participated in this study.

Materials and Procedure:

Canadian Test of Basic Skills (CTBS)-Yellowstone Story: Comprehension Section (King, 1982). The Yellowstone Story from the CTBS has been assessed at a reading grade level of 9-10 (new Dale-Chall readability coefficient). This story was chosen since the vocabulary demand was several grade levels above the children's grade 4 level. The advanced vocabulary increased the chances that students would not know certain words presented to them in the narrative. As in Study 1, students were first required to read the story and answer a series of comprehension questions. On the next page, students were asked to indicate how well they knew words. Students were instructed to indicate how well they knew the words which were bolded in the narrative. Students were instructed to rate the word in the following categories: They had never seen the word before (do not know the word); have seen the word but did not know what the word meant; know what the word means but do not use the word regularly; or know what the word

means and use it on a regular basis. To make sure that the students were not falling into a response set, several pseudo-words (e.g. **laift**) were implanted and bolded in the narrative. Students were asked to rate these words as indicated above. On the final two pages, the narrative was reproduced for the third time and students were asked to define the bolded words within the narrative as they had done in Study 1.

Results and Discussion:

Table 3 shows the percentage correct of the defined words by the ratings of the corresponding words (10 words). The overall percentage correct of the definitions indicates a range of difficulty of words with **petrified, accumulate** and **geologist** being the most difficult words to define. However, the ratings of word knowledge as assessed by this method indicates that students at least had some knowledge of these words. Finally, students were accurate in identifying that they did not know what the pseudo-words meant, indicating that they were not simply claiming to know all the words.

In order to understand the accuracy of these students' responses, it was necessary to look at the agreement between the word ratings and the corresponding open-ended definitions of the same word. This effort resulted in the development of the following matrix as shown in Table 4. This matrix outlines how *accurately* children estimated their own ability to define words: *Under-estimators* were those students who rated their knowledge of a specific word lower than their ability to define the word; *Accurate Estimators* were those students who matched their rating of their knowledge of a specific word with their ability to define that word; and *Over-Estimators* were those students who rated their knowledge of a word above that of their ability to define the word. These classifications are shown in Table 4.

Table 5 addresses each word in the Yellowstone story which was both rated and defined. The number and the percentage of under-estimators remained the same across the words as was the case for the accurate estimators (with the exception of the words, **petrified, accumulate** and **geologist**, where both the number and percentage decreased far below 90%). However, for those same words, the number and percentages of over-estimators increased. This finding may suggest that these students may over-estimate their ability to define words when they are more difficult.

The final question to answer is what is the relationship between accuracy of word knowledge and the ability to comprehend the narrative. Table 6 shows the difficulty level of each comprehension question along with the key words in each question which were on the survey. Of greater interest is the percentage correct if the students knew how to define the key word and the percentage correct if they did not know how to define the key word. With some exceptions,

knowing the meaning of a word corresponded with a greater probability of answering the comprehension question correctly. As with Study 1, the largest differences between those who could successfully answer the comprehension questions were for inferential comprehension questions. Of interest were those questions and key words in which the predicted relationship was in the wrong direction. For example, the word **volcano** in question A3, a question which asked for the definition of **fossil**. The word **volcanic** was not a correct option so it was not important for a child to know the word **volcano** in this context.

General Discussion:

In both studies, elementary grade children were generally more successful in answering comprehension questions if they knew the meaning of key words in the question. However, even if they knew the correct meaning of the word, it would not guarantee that the students could answer the questions correctly. This observation became more salient when factual and inferential comprehension questions were compared; there are factors other than vocabulary knowledge which account for the correct answering of inferential comprehension questions, such as the ability to keep disparate facts in short-term memory and the ability to reason.

The second study added information on the metacognitive ability of students to assess their own knowledge. It appears that students can accurately assess word knowledge when words are of easy to moderate levels of difficulty. In those instances where words are generally difficult for the population studied, students tend to over-estimate their own ability to define words. Since the sample was small enough, we were able to track some of the students who overestimated their word knowledge and found they consistently gave an incorrect response to the specific comprehension question. This clinical analysis emphasizes the need to for teachers to address and teach the skill of accurately identifying word knowledge. The second study emphasizes the need to help students assess their own word knowledge when reading material is more difficult than their frustration level of reading.

The second study indicates that self-reports of word knowledge by themselves can be unreliable. It is important to use other methods to assess vocabulary knowledge, such as definitions of key words and the teaching children how to figure out word meanings. Another factor which may improve upon the accuracy of word knowledge is to remove the focus of the child to the word by asking them if the word is one which other students may find difficult. This survey asked each child directly which may be difficult for at least two reasons; it asks a child to admit to his own short-comings in word knowledge and it may be more difficult for a student in elementary school to *observe* his own process in word knowledge than to *observe* others, which

he has probably been doing for some time (Gordon Wells, personal communication).

The use of self-report methods of vocabulary knowledge may become useful once students' word knowledge and their metacognition about word knowledge increases. Teachers and educational researchers alike should be aware of the developmental process of *word consciousness* in children. Future studies should look at this process across various ages and grades with a variety of graded reading material. Methods of assessment of word consciousness should not be restricted to self-report but should also include open-ended definitions and more standardized approaches to identifying various types of comprehension questions (i.e. factual versus inferential comprehension questions). Teachers can use this corpus of research to become aware of the need to actively assess and teach vocabulary in the lower grades. Teaching vocabulary is not just for the sake of improving expressive vocabulary but also serves to improve listening and reading comprehension, the ultimate goals of literacy.

TABLE 1: Study 1: Percentage Correct for Word Definitions for Total Sample

Word	Percentage Correct (Grade 5, Grade 6)
Batting	82 (89, 76)
Lightning Bug	90 (78, 100)
Wingless	95 (100, 90)
Member	90 (88, 90)
Similar	95 (89, 100)
Larger	97 (94, 100)
Dim	90 (83, 95)
Flickering	90 (83, 95)
Shelled	46 (56, 38)
Nut Grinder	95 (94, 95)
Prepare	56 (50, 62)
Describe	90 (94, 86)
Peel	92 (89, 95)
Divided	82 (78, 86)
Rodeo	54 (44, 62)
Holed	36 (39, 33)
Supplies	87 (83, 90)
Catalogue	64 (56, 71)
Dragon	85 (83, 86)
Scales	56 (44, 67)
Moveable	87 (78, 95)
Recreation	44 (33, 52)
Unusual	97 (94, 100)
Armed Forces	90 (89, 90)
Afloat	90 (89, 90)
Signals	90 (72, 67)
Rescue	95 (94, 95)
Entertainment	46 (39, 52)

Word	Percentage Correct (Grade 5, Grade 6)
Batting	82 (89, 76)
Shipwrecked	77 (61, 90)
Carriers	41 (39, 43)
Rugged	56 (50, 62)
Attention	59 (39, 76)

TABLE 2: Overall Percentage Correct for Comprehension Questions (study 1) and Percentage Correct Dependent upon Word Knowledge (N=39) (number of subjects in parentheses).

Question	Percentage Correct	Word		Percentage Correct for Comp. Questions	Prediction
			If children knew Word	If children did not know word	
D13	100	Peeled	92(36)	100(3)	Little diff.
		Divided	82(32)	100(7)	WW
D12	97	Describe	97(32)	100(7)	Little diff
C9	95	Batting	94(30)	100(7)	Little diff
C10	95	Lightning Bugs	97(34)	100(7)	Little diff
C11	95	Lighting Bugs	100(35)	50(2)	RW
		Flickering	97(34)	75(3)	RW
D14	95	-			
E19	90	Supplies	91(31)	80(4)	RW
		Catalogue	96(24)	79(11)	RW
F21	90	Dragon	91(30)	83(5)	RW
		Scales	95(21)	82(14)	RW
		Moveable	91(31)	80(4)	RW
E17	85	-			
E16	79	-			
F22	79	Unusual	82(31)	0	RW
E18	77	Supplies	77(26)	80(4)	Little diff
F20	69	Recreation	94(16)	50(11)	RW
F23	67	Afloat	66(23)	75(3)	WW
		Signals	67(18)	67(8)	Little diff
		Rescue	68(25)	50(1)	RW
		Entertainment	78(14)	57(12)	RW

Question	Percentage Correct	Word		Percentage Correct for Comp. Questions	Prediction
			If children knew Word	If children did not know word	
		Shipwrecked	67(20)	67(6)	Little diff
F25	67	-			
F24	51	Carriers	69(11)	39(9)	RW
		Rugged	64(14)	35(6)	RW
		Attention	57(13)	44(7)	RW

Table 3: Study 2: Percent Correct Definitions by Ratings for 10 Words (number of children in parentheses) N=22

% (n)	Not Known	Seen But Did Not Know	Know But Not Used	Know and Used	Overall Correct Definitions
Real Words					
Strange			100 (5)	82 (17)	86(19)
Volcano	100 (1)		77 (13)	88 (8)	82(18)
Remarkable	100 (1)	0 (1)	93 (15)	80 (5)	86(19)
Fossil		0 (1)	79 (19)	50 (2)	73(16)
Accompany	0 (1)	20 (1)	83 (12)	75 (4)	64(14)
Petrified	0 (1)	10 (11)	44 (9)	0 (1)	23(5)
Accumulate	0 (8)	0 (9)	50 (4)	0 (1)	9(2)
Geologist	0 (2)	0 (5)	29 (14)	0 (1)	18(4)
Pseudo-words					
Hets	0 (19)	0 (2)			0
Shif	0 (17)	0 (1)	0 (4)		0

Table 4: Agreement Between Word Ratings and Open-Ended Definitions Matrix.

	Open Ended Definitions		
Self-Report Ratings	Doesn't Know Word	May Know Word	Knows Word
Not Seen/Not Known	Accurate	Under-Estimate	Under-Estimate
Seen Word/Don't Know Word	Accurate	Accurate	Under-Estimate
Know Word/ Don't Use Word	Over-Estimate	Accurate	Accurate
Know and Use Word	Over-Estimate	Over-Estimate	Accurate

Table 5: Percentage of Word Definitions Correct as a Function of the Accuracy of the Students' Ratings of Word Knowledge (percentage of cases in parentheses) (N=22)

		Classification	
Real Words	Under Estimators	Accurate	Over Estimators
Strange	0	21 (95)	1 (5)
Volcano	1 (5)	20 (91)	1 (5)
Remarkable	1 (5)	20 (91)	1 (5)
Fossil	0	21 (95)	1 (5)
Accompany	1 (5)	20 (91)	1 (5)
Petrified	1 (5)	15 (68)	6 (27)
Accumulate	0	20 (91)	2 (9)
Geologist	1 (5)	14 (64)	6 (27)

Table 6: **Percentages of Students Who Could Successfully Answer the Comprehension Question as a Function of Whether They Knew the Word or Not** (N=22)

Question	Percentage Correct	Word	Percentage Correct on Comprehension Question if		
			Children Knew Word	Children did not know word	Expected Difference
A2	45	Volcano	44	50	WW
A3	45	Fossil	60	12	RW
		Volcano	39	75	WW
A4	36	Fossil	50	0	RW
		Petrified	60	29	RW
A5	45	Volcano	56	0	RW
		Petrified	60	41	RW
A6	18	Fossil	19	17	Little diff
		Petrified	20	18	Little diff
A7	18	Fossil	25	0	RW
		Petrified	40	12	RW

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